

Anatomy of the oesophagus

Vishy Mahadevan

Abstract

The oesophagus is a conduit between the pharynx and stomach. It may be described as consisting of cervical, thoracic and abdominal parts. The oesophagus is lined throughout, by stratified squamous epithelium. The blood supply of the oesophagus is derived from multiple sources, including the inferior thyroid artery, the descending thoracic aorta and the left gastric artery. At the lower end of the oesophagus, within the mucosa and submucosa, is an important porta-systemic venous anastomosis between oesophageal tributaries of the left gastric vein and oesophageal tributaries of the azygos vein. This anastomosis assumes very great clinical significance in portal hypertension. Both at its proximal and distal ends, the oesophagus possesses a sophisticated sphincter mechanism. The proximal sphincter acts to regulate and control entry of food and liquid into the oesophagus. At the distal end, there is no demonstrable anatomical sphincter. Nevertheless, a number of factors acting in concert, provide a very efficient 'physiological' sphincter mechanism that acts to prevent reflux of acidic gastric contents into the oesophagus. The oesophagus is susceptible to a number of pathological conditions, both congenital and acquired, which may require surgical management. These include congenital oesophageal atresia, functional disorders such as achalasia cardia and hiatus hernia, corrosive strictures, traumatic oesophageal perforation and oesophageal cancer.

This article describes, in detail, those aspects of the topographical anatomy of the oesophagus which are of particular relevance to clinical diagnosis and surgical management.

Keywords Blood supply; lower and upper oesophageal sphincter; lymphatic drainage; porta-systemic venous anastomosis; stratified squamous epithelium

Oesophagus

The oesophagus is the direct distal continuation of the pharynx and connects the latter to the stomach. It commences in the neck at the level of the lower border of the cricoid cartilage. The oesophagus descends into the thorax where it lies successively in the superior and posterior mediastina before crossing the diaphragm to enter the abdominal cavity (Figures 1 and 2). The oesophagus may therefore conveniently be subdivided for descriptive purposes into three parts: cervical, thoracic and abdominal. Of these, the thoracic part is the longest, and may be further subdivided into a superior mediastinal segment and a posterior mediastinal segment.

The oesophagus is a muscular, tubular conduit with an average adult length of 25–30 cm. It is well tethered at its

junction with the pharynx and also where it traverses the oesophageal hiatus in the diaphragm. Between these two points of relative fixity, the oesophagus is only loosely adherent to adjacent structures and may be mobilized during surgery without undue difficulty.

Oesophageal sphincters

The oesophagus possesses a sphincter mechanism at either end. The proximal sphincter termed the upper oesophageal sphincter, is none other than the cricopharyngeus part of the inferior pharyngeal constrictor. The lower oesophageal sphincter also known as the cardiac sphincter is neither anatomically nor histologically demonstrable. Nevertheless, there is incontrovertible physiological and manometric evidence of a sphincter mechanism at the lower end of the oesophagus. The following factors have been postulated to contribute to the mechanism:

- positive intra-abdominal pressure acting to compress the short abdominal part of the oesophagus
- a physiological high-pressure zone at the lower end of the oesophagus, which can be demonstrated by oesophageal manometry
- the natural obliquity of the oesophago-gastric angle producing a valve-like effect (Figure 1).
- pinch-cock effect of the crural sling of the diaphragm (Figure 1).
- plug-like action of the mucosal folds at the cardiac orifice (see Figure 4).

Course of the oesophagus

Commencing in the midline, the oesophagus inclines slightly to the left in the lower part of the neck before entering the superior mediastinum in the midline. Deviating gradually and slightly to the left, it comes to lie behind the left main bronchus before crossing over to the right at the level of the T6 vertebra. Finally it crosses over to the left of the midline to lie anterior to the descending thoracic aorta before traversing the diaphragm at the level of the T 10 vertebra. (Figure 1).

There are four points of narrowing along the length of the normal oesophagus and these are seen as indentations on a 'barium swallow' radiological examination. The first of these constrictions is at the very commencement of the oesophagus and is due to the upper oesophageal sphincter (cricopharyngeus). This is also the narrowest part of the oesophagus. The second constriction is at the area of contact between the aortic arch and the left wall of the oesophagus. The third constriction is where the left main bronchus contacts the left side of the oesophagus. The fourth and final constriction is at the oesophageal hiatus in the diaphragm. In an average adult these four constrictions are, respectively, 15 cm, 23 cm, 27 cm and 39 cm from the incisor teeth.

Topographical relations: (Figures 1 and 2)

Immediately anterior to the cervical oesophagus lies the trachea. Posterior to the cervical oesophagus and separated by the prevertebral fascia and prevertebral muscles are the 6th and 7th cervical vertebral bodies. Lateral to the cervical oesophagus on either side is the medial surface of the corresponding thyroid

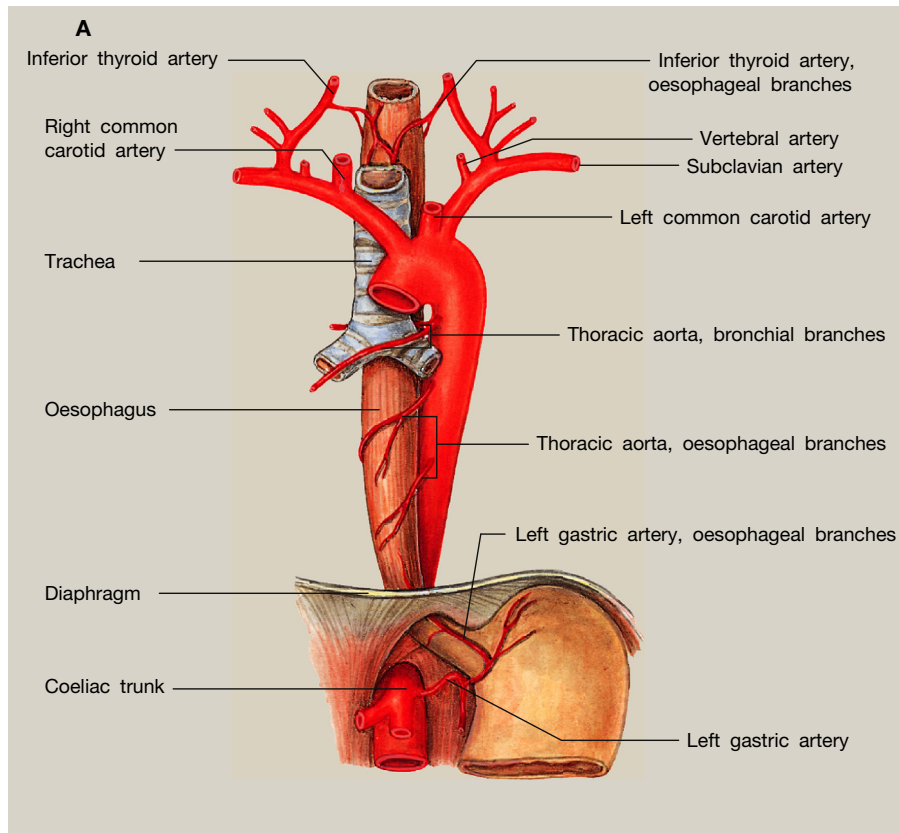


Figure 1 Course of oesophagus and oesophageal arterial supply (as viewed from the front).

lobe, while still more laterally is the ipsilateral carotid sheath containing the common carotid artery, internal jugular vein and the vagus nerve. Lying anterior to the oesophagus are the right and left recurrent laryngeal nerves, each lying in the trachea-oesophageal groove of its side. To the left of the oesophagus in the root of the neck is the termination of the thoracic duct.

In the superior mediastinum the oesophagus is related posteriorly to the upper four thoracic vertebrae whose bodies are covered anteriorly by the prevertebral muscles and prevertebral fascia. Related to the right of the oesophagus in the superior mediastinum is the vena azygos on its way to the superior vena cava, while to the left of the oesophagus are the aortic arch, thoracic duct and the left recurrent laryngeal nerve. *An aneurysm of the aortic arch may thus compress the oesophagus and cause dysphagia.*

In the posterior mediastinum, the oesophagus lies anterior to the thoracic vertebrae 5–10.

Crossing transversely behind the oesophagus in front of the vertebral bodies are the hemiazygos and accessory hemiazygos veins, the right posterior intercostal arteries and the thoracic duct. Posterolateral to the oesophagus on the right side is the vena azygos. To the left of the oesophagus is the descending thoracic aorta while on the right side the mediastinal pleura of the right lung is extensively and closely related to the oesophageal wall. It is for this reason that a perforation of the mid-oesophagus (be it iatrogenic or due to an invasive neoplasm) may result in a right-sided pneumothorax or a right-sided pleural effusion.

Anteriorly, the oesophagus is crossed obliquely by the left main bronchus and just below this by the right pulmonary artery. Lower down, the fibrous pericardium lies in front of the oesophagus, separating the latter from the left atrium of the heart. A grossly enlarged left atrium resulting from a tight mitral stenosis may thus compress the oesophagus and cause dysphagia, as may a neoplasm in the left main bronchus.

The abdominal part of the oesophagus (Figure 2), about 2.5 cm in length, passes through the opening formed by the two crura of the diaphragm and comes to lie in the oesophageal groove on the posterior surface of the left lobe of the liver. It is tethered to the diaphragm by the phreno-oesophageal ligament (Figure 4).

Surgical access to the oesophagus

The surgical approach to the cervical oesophagus is usually through an oblique incision on the left side of the neck. The carotid sheath is retracted laterally and the left thyroid lobe is mobilized to bring the oesophagus into view. The thoracic duct and the left recurrent laryngeal nerve are important anatomical hazards in this approach.

Surgical access to the middle portion of the oesophagus is best achieved by means of a right posterolateral thoracotomy through the 5th or 6th intercostal space.

However the very distal part of the intrathoracic oesophagus is best approached through a left posterolateral thoracotomy through the 7th or 8th intercostal space.

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